# PATENT ABSTRACTS OF JAPAN

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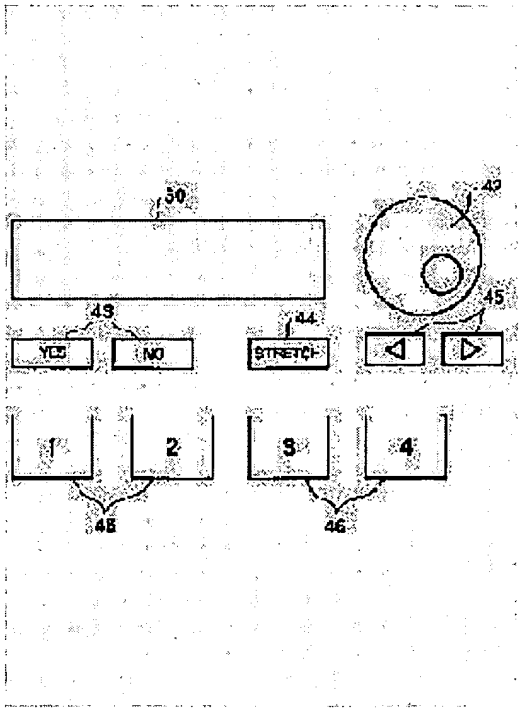
## (54) METHOD AND DEVICE FOR TIME COMPRESSION AND EXPANSION OF WAVEFORM DATA

(57)Abstract:

PROBLEM TO BE SOLVED: To reduce influence affected to sound quality of a reproduced waveform caused at the joints of a waveform block of a reproduced waveform by deciding length of a divided waveform block based on music performance timing information of waveform data.

SOLUTION: When any of waveform selecting switches 46 is pressed pressing a stretch indication switch 44, a control parameter for processing in which a reproducing time of a selected voice waveform is lengthened or shortened is set, and a state in which compression/expansion processing can be performed is made. In compression/expansion processing of a voice waveform, an original waveform is divided into plural waveform blocks, divided waveform blocks are rearranged, cross-fade processing is performed in waveform blocks, and a reproduced waveform in which a reproducing time is lengthened is made. Therefore, length of a waveform block cutting a voice waveform is decided based on music performance information stored in a voice waveform. Thus, joints of waveform blocks can be arranged regularly for music performance timing of the original voice waveform.

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examiner's decision of rejection or application converted registration]

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DETAILED DESCRIPTION

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[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the time amount compression elongation approach and equipment of a data point which compress / elongate the playback time amount of a data point.
[0002] A time stretch is in one of the edit functions, such as a sampler. This time stretch is a function which compresses into the playback time amount of arbitration the range which the data point specified, or is elongated, and the voice wave which becomes origin is started to the wave block of the die length of arbitration. According to the rate which lengthens playback time amount or is shortened, a part of wave block is twice read at the time of elongation, it is carried out, and a skip is carried out at the time of compression, and a part of wave block [ before and after ] is made to repeat mutually, and it ties, and is carried out by carrying out cross fade processing of the part to pile up.
[0003] The outline of the compression/elongation approach of the playback time amount of a data point is shown in drawing 9 . Drawing 9 (a) shows the case where drawing 9 (b) makes the die length L1 of a original wave short to the die length L2 of a playback wave (compression), when lengthening the original die length L1 of a voice wave (henceforth a original wave) to the new die length L2 of a voice wave (henceforth a playback wave) (elongation).
[0004] First, the case where the playback time amount of a original wave is elongated with reference to drawing 9 (a) is explained. A playback wave like the lower berth which has arranged, connected between each wave block by cross fade, carried out time amount elongation of the die length L1 of a original wave, and was set to L2 is generated for the wave blocks LB1-LB4 of a original wave which have the part with which LO1-LO3 (it is hereafter described as LO named generically) lapped. This playback wave that carried out time amount elongation will overlap and use the part of said LO of a original wave.
[0005] Next, the case where the playback time amount of a original wave is compressed with reference to drawing 9 (b) is explained. The wave blocks LB1-LB4 of a original wave except the part which LD1-LD4 (it names generically and is hereafter described as LD) skipped are arranged like the lower berth, between each wave block is connected by cross fade, and the playback wave which carried out time amount compression of the die length L1 of a original wave, and was set to L2 is reproduced. This playback wave that carried out time amount compression will delete and use the part of said LD of a original wave.
[0006]
[Problem(s) to be Solved by the Invention] Although cross fade of the part from which a wave becomes discontinuous as mentioned above is usually carried out in the knot part of a wave block of a playback wave, in case [ this ] cross fade is carried out, phasing (change of a phase) of a voice wave happens in that cross fade part, and this serves as an audibility top and an allophone, and it is ********. the voice reproduced since this allophone was periodically repeated with the period of the die length of a playback block and that period did not have correlation in any way with the rhythm which a voice wave has -- receiving -- conspicuous -- the tone quality of a playback-on audibility wave -- good -- since better, it has colander effect.
[0007] This invention is made in view of this trouble, and the allophone made in the knot part of a wave block of a playback wave aims at reducing the effect which it has on the tone quality of a playback wave.
[0008]
[Means for Solving the Problem] In order to solve an above-mentioned technical problem, by the time amount compression elongation approach of the data point concerning this invention When dividing a data point into time

series at two or more wave blocks and carrying out time amount compression of the data point, delete this a part of wave block, and die length is shortened. In the time amount compression elongation approach of the data point which performs time amount compression / elongation of a data point by rearranging these two or more wave blocks after overlapping this a part of wave block and lengthening die length, when carrying out time amount elongation The die length of the this wave block to divide is decided based on the performance timing information (Il Tempo of a voice wave, rhythm, the number of beats) of this data point.

[0009] Moreover, the time amount compression elongation equipment of the data point concerning this invention The storage means which memorized the data point, and a division means to determine the die length of division based on the performance timing information (Il Tempo of a voice wave, rhythm, the number of beats) of this data point, and to divide this data point into two or more wave blocks, When carrying out time amount elongation, after it deletes this a part of wave block, and shortening die length, when carrying out time amount compression of the data point, overlapping this a part of wave block and lengthening die length, it has a compression elongation means to rearrange these two or more wave blocks.

[0010] The above-mentioned performance timing information is memorized by this storage means with the data point, and above time amount compression elongation equipment can be constituted so that the die length of the wave block with which this division means reads this performance timing information from this storage means, and this divides it may be determined.

[0011]

[Function] By the conventional time amount compression elongation approach, the die length which starts a wave block from the voice wave which becomes origin is decided regardless of the performance timing (Il Tempo, rhythm, the number of beats) which the original voice wave has. For this reason, the allophone made in the knot part of a wave block in a playback wave becomes what is conspicuous to the voice by which the period of that generating became completely unrelated to Il Tempo of a voice wave, or rhythm, consequently that allophone was reproduced, and spoils the tone quality of a voice wave on audibility.

[0012] Then, he is trying to determine in this invention based on the performance timing information in which a voice wave has the die length of a wave block paying attention to the die length of the wave block which starts a voice wave. Since the allophone has the rhythm of a voice wave, and correlation, it stops being not much conspicuous on audibility, even if it can make the knot of a wave block regular to the original performance timing of a voice wave and an allophone is therefore made in the knot part of a wave block of a playback wave if it does in this way.

[0013]

[Embodiment of the Invention] Hereafter, the operation gestalt of this invention is explained with reference to a drawing. Drawing 1 is drawing showing the block configuration of the voice wave processor carrying the time amount compression elongation equipment concerning this invention. With this example equipment, the die length which starts a voice wave to two or more wave blocks based on musical timing information (Il Tempo, rhythm, the number of beats, etc.) is determined, and playback time amount of a voice wave is lengthened, or is shortened.

[0014] In drawing 1 , CPU1 performs processing which lengthens playback time amount of a voice wave, or shortens it, and processing of the whole equipment. The below-mentioned control program for the processing which ROM2 lengthens the control program of the whole equipment and playback time amount of a voice wave, or is shortened is stored. The data of a voice wave [ RAM /3 ] and data of a CPU working-level month are stored. A control unit 4 and a display 5 are for checking the parameter which controls the whole equipment or inputting. A/D converter 6 and D/A converter 7 are for performing I/O of a voice wave.

[0015] It is the example of a configuration of the panel for operating example equipment to drawing 2 . In drawing 2 , 50 is the display screen of a display 5. A stretch directions switch for the button switch for the rotary encoder used in case 42 sets up the value of a control parameter, and 43 performing actuation, or stopping, and 44 to direct the processing which lengthens playback time amount of a voice wave, or shortens it, and 45 are the parameter selecting switches for choosing the class of control parameter. 46 is a wave-selection switch for making a voice wave pronounce and checking, and can choose the voice data point beforehand prepared for RAM3 at each switch correspondence.

[0016] If one of the wave-selection switches 46 is pushed, pushing the stretch directions switch 44 if the operation information by these handlers is explained, the control parameter for the processing which lengthens the selected playback time amount of a voice wave, or is shortened is set up, and it will be in the condition that compression/elongation processing can be performed. A control parameter is displayed on a display screen 50, and the

class is switched by operating the parameter selecting switch 45. The control parameter displayed on the display screen 50 can set the value as arbitration using the rotor RIEN coder 42. The control parameter which can be set up in the rotor RIEN coder 42 has several Q of the wave block which starts the playback range of the voice data point assigned to the wave-selection switch 46 and a voice data point (and the start address S1 of a data point, and address E1), the number B of beats of a voice data point, and the playback time amount of a voice wave to the companding rate R which lengthens or is shortened, and per beat etc.

[0017] Hereafter, actuation of this example equipment is explained with reference to the flow chart of drawing 3 and drawing 4 . Drawing 3 is a flow chart which shows the flow of the panel processing for making it short in lengthening playback time amount of a voice wave. This panel manipulation routine is a routine for supervising the condition of the handler on a panel in the main routine of example equipment, and when it pushes any of the wave-selection switch 46 they are, pushing the stretch directions switch 44, it is called and performed. In addition, subsequent explanation explains by calling a playback wave the voice wave made by lengthening a original wave and playback time amount, or shortening the voice wave of the origin made short in lengthening playback time amount.

[0018] First, a control parameter is set up (step S1). In a setup of a control parameter, several Q (unit: a piece/beat) is set up using the handler of the wave block started to the companding rate R (unit: %) which lengthens the number B of beats (unit: beat), and playback time amount, or shortens them, and per beat to the original wave currently assigned to the wave-selection switch 46 pushed with the stretch directions switch 44. In addition, Il Tempo Temp may be set up instead of the number B of beats of a original wave, or you may make it set up Il Tempo Temp of a playback wave instead of the companding rate R here.

[0019] After setting processing of a control parameter finishes, the guidance sentence of "whether to perform processing" is displayed on the display screen 50 (step S2). If "YES" is chosen with a button switch 43, compression/elongation processing of step S3 will be performed, and if "NO" is chosen, it will return to a main routine.

[0020] In compression/elongation processing of a voice wave of step S3, a original wave is divided into two or more wave blocks, and the playback wave which rearranged the wave block which divided, carried out cross fade processing between wave blocks, lengthened playback time amount or shortened it is made. About the detail of this compression/elongation processing, it mentions later.

[0021] If compression/elongation processing is completed, the guidance sentence "is a new voice wave assigned?" which asks whether a playback wave is saved in the display screen 50 will be displayed (step S4). A playback wave will be assigned to the wave-selection switch 46 to which the original wave was assigned if "YES" is chosen with a button switch 43 (step S5). When "NO" is chosen, processing is ended without being assigned to the wave-selection switch 46, and a playback wave returns to a main routine.

[0022] Next, compression/elongation processing of a voice wave is explained with reference to the flow chart of compression/elongation manipulation routine of drawing 4 , and the timing diagram of compression/elongation processing of drawing 5 and drawing 6 . Here, drawing 5 divides a original wave into two or more blocks, and how drawing 6 carries out time amount compression of the way of carrying out time amount elongation of each wave block by relocation / carrying out cross fade again is shown. In compression/elongation manipulation routine of drawing 4 , using the control parameter set up in the panel manipulation routine of drawing 3 , and the playback range of a original data point (and the start address S1 of a data point, and address E1), a original wave is divided into two or more wave blocks, those divided wave blocks are rearranged to time series, cross fade processing is performed between wave blocks, and playback time amount of a original wave is lengthened, or is shortened.

[0023] First, the wave block length is determined (step S31). In decision processing of the wave block length, the number of partitions N of a wave block, the die length L1 of a original wave, die-length [ of a wave block of a original wave ] L1B, the die length L2 of a playback wave, and the value of five parameters of die-length L2B of the wave block of a playback wave are determined automatically. Hereafter, the method of these decision is explained.

[0024] Several N (unit: individual) which divides a original wave into two or more wave blocks is calculated by calculating N=QxB using several Q (unit: a piece/beat) of the number B of beats (unit: beat), and the wave block started to per beat. By this, the musical timing information of a voice wave will be reflected in the number of partitions N of a wave block.

[0025] the die length L1 (unit: sample) of a original wave -- a data point -- and it asks by calculating L1=E1-S1 using the address E1 and a start address S1.

[0026] It asks for die-length L1B (unit: sample) of the wave block when starting a original wave to two or more wave blocks by calculating L1 B=L1/N. Die-length L1B of this wave block corresponds to the "note" of the die length of the arbitration in a original wave. For example, if the die length of a quarter note is made into one beat, die-length L1B of a wave block will become 1/Q of the die length of the quarter note of a original wave, i.e., the die length of 1 for an integer.
[0027] The die length L1 of a original wave and the companding rate R of playback time amount are used for the die length L2 of a playback wave, and it is L2=L1x (R/100).
It asks by calculating.
[0028] Die-length L2B of the wave block when dividing a playback wave into two or more wave blocks like a original wave is calculated by calculating L2B=L2/N. Die-length L2B of this wave block corresponds to the "note" of the die length of the arbitration in a playback wave. For example, if the die length of a quarter note is made into one beat, die-length L2B of a wave block will become 1/Q of the die length of the quarter note of a original wave, i.e., the die length of 1 for an integer.
[0029] If decision processing of a wave block is completed, a working-level month parameter will be initialized (step S32). In this initialization processing, Counter C and three parameters of pointers P1 and P2 are initialized.
[0030] First, the value of the counter C which processes a wave block is set to "0." In the processing which makes a playback wave, whenever this counter C performs relocation and cross fade processing about one wave block, it increases one, and when all wave blocks are processed, the value of Counter C is set to "N."
[0031] The start address S1 of the memory area where the original wave is stored is set to a pointer P1. Moreover, the start address S2 of the memory area where a playback wave is stored is set to a pointer P2. These pointers P1 and P2 will show the start address of the wave block under current activity on a voice wave.
[0032] Next, it judges whether the companding rate R of a voice wave is investigated and performing elongation processing of a voice wave or performing compression processing, or compression/elongation is performed (steps S33 and S35). If it is R> 100, it is elongation processing and R< 100 and it is not compression processing and its any, either, it will judge with not performing compression/elongation. Hereafter, elongation processing and compression processing are explained to a detail.
[0033] Processing which lengthens playback time amount of a original wave is performed by R> 100, i.e., elongation processing, (step S34). First, the data of the wave block covering die-length L1B are read from the location of the pointer P1 on the address with which the original wave is stored, and it copies to the memory area where this is stored in a playback wave over die-length L1B from the location of the pointer P2 on the address (writing).
[0034] Furthermore, it ties, reading the 2 times reading part (part of die-length LO explained by drawing 9 ) of a original wave, and carrying out cross fade to the tail side of the wave block data by which the copy was carried out [ above-mentioned ]. Specifically The location of the pointer P1 of a original wave block to (L1Bx2-L2B-LF), That is, the data point for die length (L2B-L1 B+LF) is read from the location of [P1+ (L1Bx2-L2B-LF)]. Only die-length LF from the part of the end of the wave block to which the data point was copied The front address position, It copies over a part for die length (L2B-L1 B+LF) from a location, and that is, (P2+L1 B-LF) carries out cross fade processing of the cross fade part (die-length LF) with which a data point laps in the case of the copy (step S34). Die-length LF (unit: sample) of a cross fade part with which this data point laps is determined as predetermined constant value according to the system.
[0035] If drawing 5 explains this elongation processing, so that the wave block (die-length L1B) corresponding to the "note" of the die length of arbitration may turn into a wave block (die-length L2B) corresponding to the "note" of the die length of arbitration on a playback wave on a original wave From a part of wave block (die-length L1B) of a original wave, i.e., the back end of a wave block of a original wave, read the part of die-length LO= (L2B-L1 B+LF) to this side twice, and it is made it. Only die-length LF is laid on top of the back end part of a wave block of the front end part of this part that carried out reading twice of a original wave, and cross fade processing of that superposition part (die-length LF) is carried out.
[0036] On the other hand, processing which shortens playback time amount of a voice wave is performed the case (step S35) of R< 100, i.e., compression processing of a voice wave, (step S36). First, the data of a wave block of die-length L2B are copied to the memory area where it is stored in a playback wave ranging from the location to die-length L2B of the pointer P2 on the address from the location of the pointer P1 on the address which has stored the original wave.
[0037] furthermore, from the pointer P1 on the address with which the original wave is stored about the wave block

data for die-length L1 B minutes The data point for die-length LF from the location of a pointer P1 to (L1 B-LF), i.e., the location of [P1+ (L1 B-LF)] From the back end part of the wave block copied above, by the cross fade length LF A front location, It copies ranging from the location to the cross fade length LF, and that is, (P2+L2B-LF) carries out cross fade processing of the cross fade part (die-length LF) with which a data point laps in that case (step S36).
[0038] If this compression processing is explained with reference to drawing 6 , so that the wave block (die-length L1B) corresponding to the "note" of the die length of arbitration may turn into a wave block (die-length L2B) corresponding to the "note" of the die length of arbitration on a playback wave on a original wave A part of wave block (die-length L1B) (die-length L1 B-L2B) of a original wave A skip, Furthermore, the part of the cross fade length LF is read from the back end of a wave block (die-length L1B) of a original wave to this side, and cross fade processing of superposition and its piled-up part is carried out at the part of die-length LF by the side of the back end of a wave block (die-length L2B) of this read part of a playback wave. In addition, if drawing 6 shows die-length LD of the skip section of previous drawing 9 (b), it corresponds to LD= (L1 B-L2B-LF).
[0039] If compression/elongation processing of a voice wave finishes, a working-level month parameter will be updated (step S37). That is, a pointer P1 is made to increase by die-length L1 B minutes, and a pointer P2 is made to increase by die-length L2B. Then, one counter C is made to increase. And processing will be ended, if processing is repeated and a value is set to "N" until the value of this counter C is set to "N" (step S38). The playback wave which lengthened playback time amount of a original wave, or was shortened by this is made.
[0040] In operation of this invention, various deformation gestalten are possible. For example, in an above-mentioned example, although he is trying to set up altogether several Q of the wave block started to the number B of beats, the companding rate R of playback time amount, and per beat at step S1 of a panel manipulation routine using a handler, the number B of beats may be memorized with wave-amplitude data as a data point. Moreover, several Q may be beforehand included in an operation as a constant of the wave block started to per beat. Thus, if it sets, in lengthening playback time amount or shortening, a user will just come to set up the companding rate R. In this case, step S1 of said panel manipulation routine is transposed to the flow shown in drawing 7 . That is, the number B of beats is read from a storage means to memorize a voice data point, it considers as the number B of beats of a control parameter (step S11), and the rate (%) inputted by the handler is set to the companding rate R of a control parameter (step S12).
[0041] Moreover, what is necessary is for there to be some which have memorized the Il Tempo information (a part for number/of beats) as a data point, and just to transpose to the flow which shows step S1 of the panel manipulation routine of drawing 3 to drawing 8 in this case. Namely, the number B of beats is computed by reading the Il Tempo information Temp on a data point from a storage means, and carrying out the multiplication of the wave length (minute) to the Il Tempo information Temp (a part for number/of beats) (step S14). Memory space is obtained from the start address and the end address of a data point as address length. Since the sampling frequency of a data point is known beforehand, said address length is convertible as time amount (minute) from the sampling frequency. What is necessary is just to set up the companding rate R, in a user's lengthening playback time amount or shortening also in this case (step S15).
[0042]
[Effect of the Invention] As explained above, according to this invention, the effect which the allophone made in the knot part of a wave block of a playback wave stops being conspicuous, and it has on the tone quality of a playback wave and which is not desirable can be reduced.

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DESCRIPTION OF DRAWINGS

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[Brief Description of the Drawings]
[Drawing 1] It is drawing showing the block configuration of the voice wave processor carrying the time amount compression elongation equipment of the data point concerning this invention.
[Drawing 2] It is drawing showing the example of a configuration of the panel of example equipment.
[Drawing 3] It is the flow chart which shows the panel manipulation routine in the main routine performed with example equipment.
[Drawing 4] It is the flow chart which shows time amount compression / elongation manipulation routine in the panel manipulation routine of an example.
[Drawing 5] It is the timing diagram which shows the situation of time amount elongation of the data point in an example.
[Drawing 6] It is the timing diagram which shows the situation of time amount compression of the data point in an example.
[Drawing 7] It is the flow chart of the modification part in other examples of this invention.
[Drawing 8] It is the flow chart of the modification part in other examples of this invention again.
[Drawing 9] It is drawing explaining the conventional time amount compression / elongation approach.
[Description of Notations]
1 CPU (Central Processing Unit)
2 ROM (Read Only Memory)
3 RAM (Random Access Memory)
4 Handler
5 Display
6 A/D Converter
7 D/A Converter
42 Rotary Encoder
43 Button Switch
44 Stretch Directions Switch
45 Parameter Selecting Switch
46 Wave-Selection Switch
50 Display Screen of Drop

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DRAWINGS

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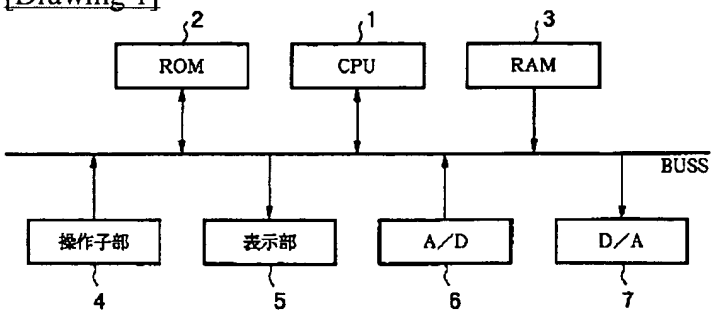
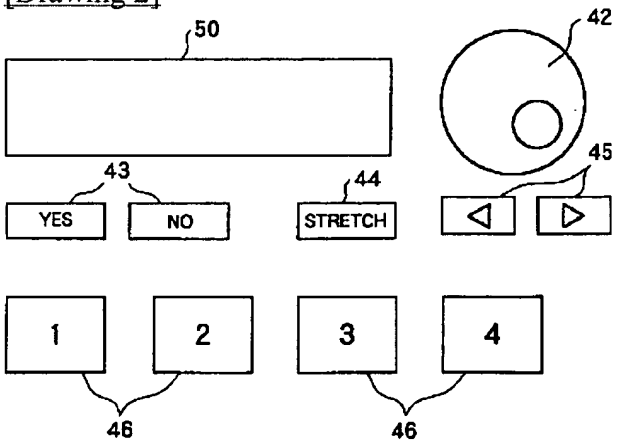
[Drawing 1]

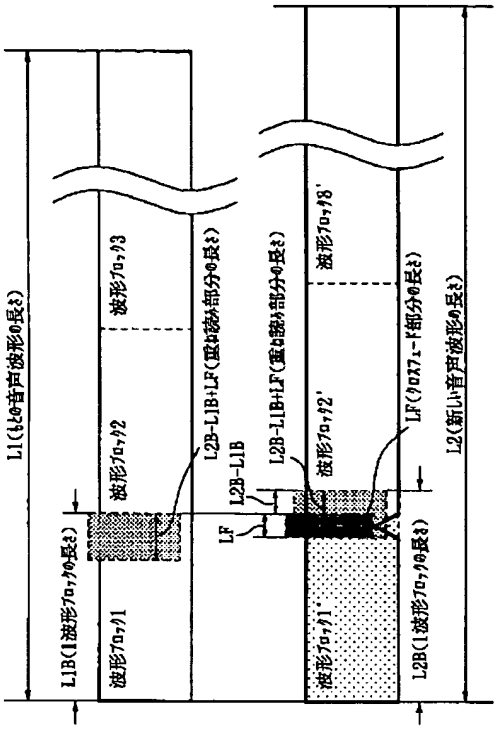



[Drawing 2]




[Drawing 5]

再生時間を長くするとき

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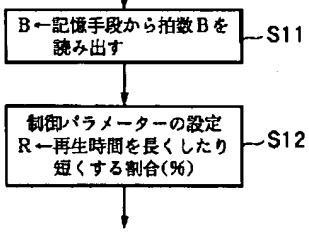


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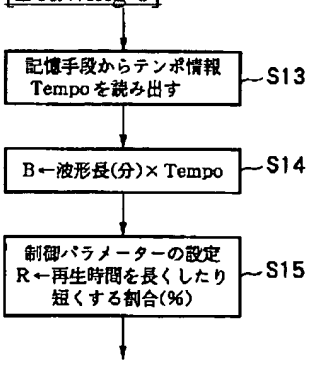
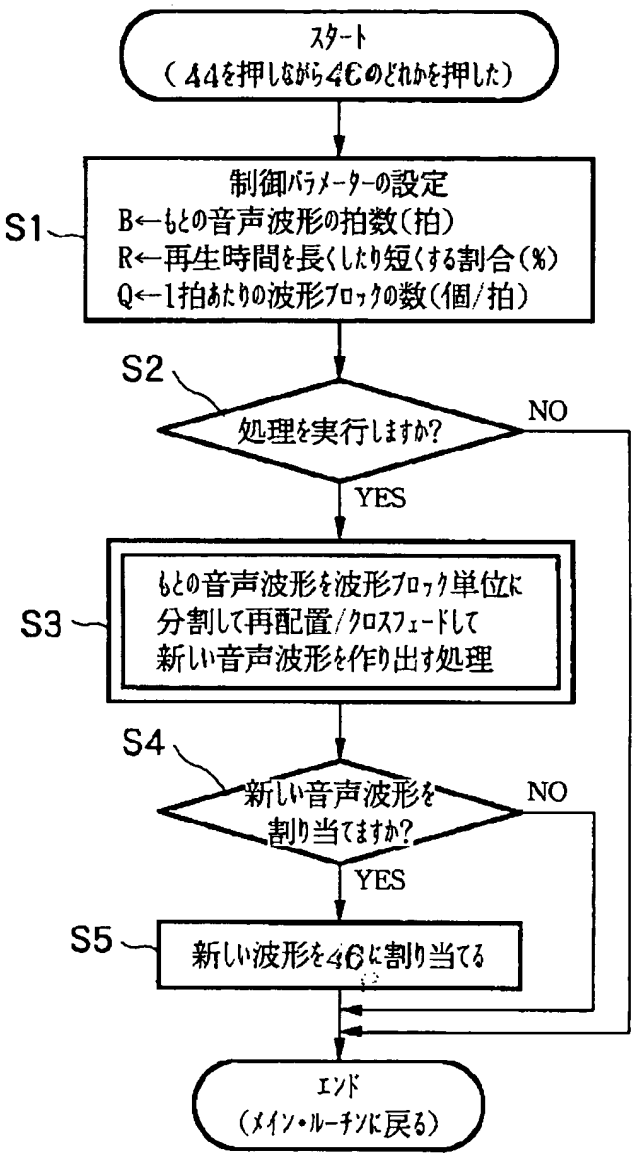
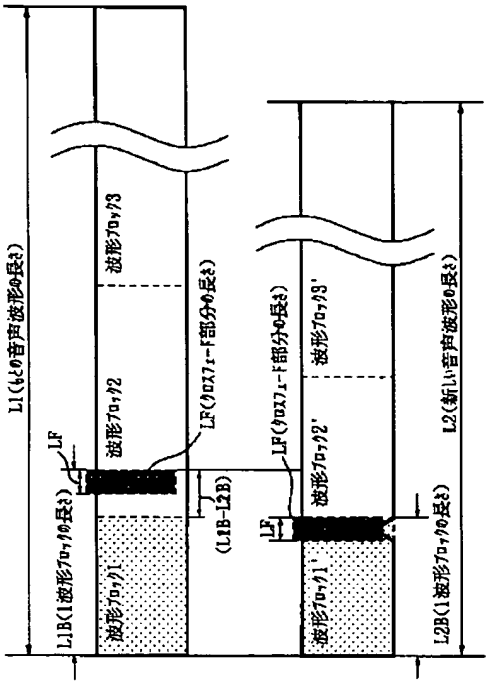



[Drawing 3]

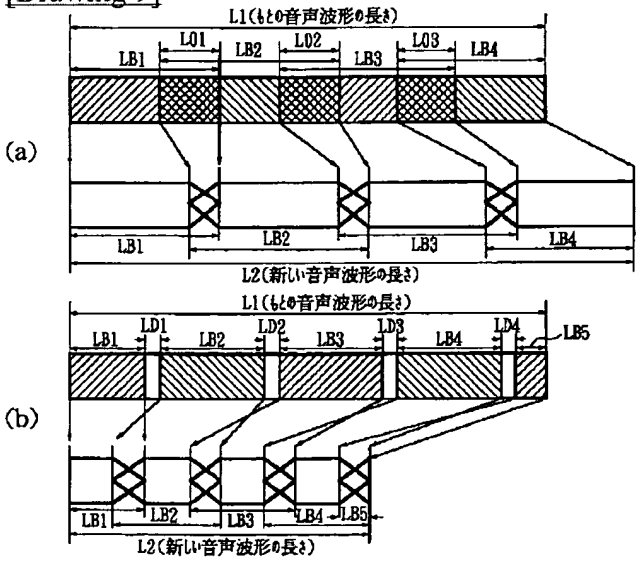

スタート
(44を押しながら46のどれかを押した)
制御パラメーターの設定
B←もとの音声波形の拍数(拍)
R←再生時間を長くしたり短くする割合(%)
Q←1拍あたりの波形ブロックの数(個/拍)
S1
S2
処理を実行しますか?
NO
YES
もとの音声波形を波形ブロック単位に
分割して再配置/クロスフェードして
新しい音声波形を作り出す処理
S3
S4
新しい音声波形を
割り当てますか?
NO
YES
S5
新しい波形を46に割り当てる
エンド
(メイン・ルーチンに戻る)

[Drawing 6]

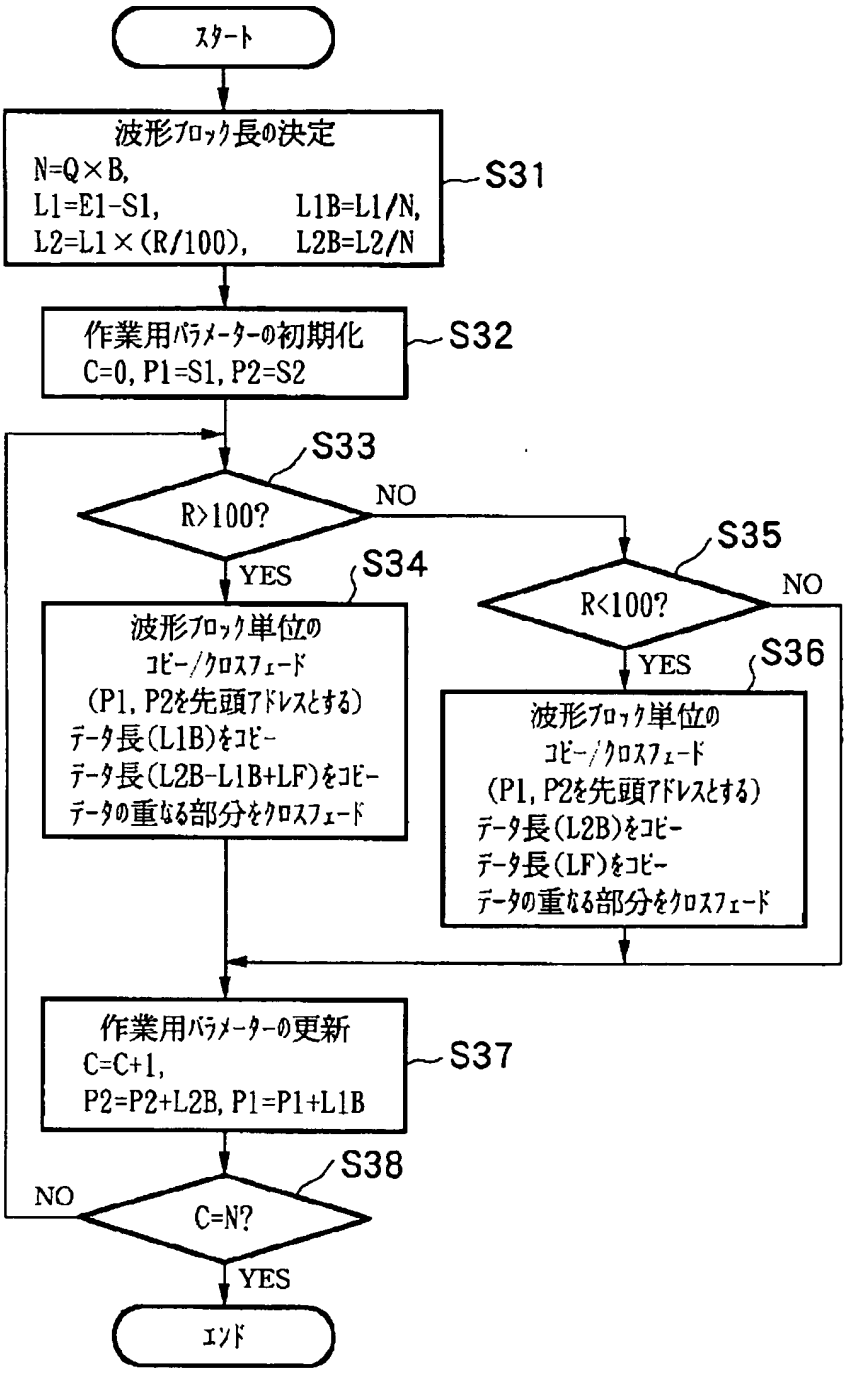
再生時間を短くするとき




[Drawing 9]




[Drawing 4]

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